

REMARKS

These amendment and remarks are filed in response to the final Office Action mailed May 25, 2007. For the following reasons, this amendment should be entered, the application allowed, and the application passed to issue. This amendment should be entered as it clearly places the application in condition for allowance and no new matter is introduced. The amendment to claim 1 is supported by the specification at page 14, line 24 to page 25, line 13; and Examples 1-3. Claims 16, 21, and 27 have been amended to depend from claim 1.

Claims 1, 5, 7, 14, 16, 18, 20-24, 26, 27, 29-32, and 36 are pending in this application. Claims 1, 5, 7, 14, 16-18, 20-24, 26-32, and 36 were rejected. Claims 1, 16, 21, and 27 have been amended in this response. Claims 2-4, 6, 8-13, 15, 19, 25, and 35 were previously canceled. Claims 17, 28, 33, 34, and 37 have been canceled in this response.

Claim Rejections Under 35 U.S.C. § 103

Claims 1, 7, and 27-32, and 35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Delnick (U.S. Patent No. 5,948,464) in view of Maeda et al. (U.S. Patent Publication No. 2003/0113626). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested. The following is comparison between the invention as claimed and the cited prior art.

An aspect of the invention, per claim 1, is a lithium ion secondary battery comprising a porous film interposed between the positive electrode and the negative electrode. The porous film is adhered to a surface of at least one of the positive electrode and the negative electrode. The porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler. The resin binder comprises a plurality of resin binders including core-shell type rubber particles and other resin

binder. The rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit. The other resin binder comprises at least one selected from the group consisting of fluorocarbon resins, cellulose resins, and polyvinyl pyrrolidone. The ratio of the core-shell type rubber particles to the total amount of resin binders is 20 to 80 wt. %.

With respect to claim 1, the Office Action asserted that the rubber particles of Maeda et al. include acrylonitrile, acrylate, or a methacrylate and that the surface of the particles necessarily is adhesive because it is a binder. As regards claim 27, the Office Action averred that the amount of resin binder on one side is necessarily smaller than the second side because the particles are so small that it is not possible to have equal amounts on both sides without a controlled method of applying the separator ink.

The combination of Delnick and Maeda et al. do not suggest the claimed lithium ion battery. Contrary to the Examiner's assertions, there is no suggestion or motivation to combine Maeda et al. and Delnick to achieve the claimed lithium ion secondary battery. Maeda et al. describe a long "laundry list" of binders for use in **battery electrodes**, an active component of the battery. There is no suggestion to select the specifically claimed binders for use in a **porous film**, an inactive component of the battery.

Neither Delnick nor Maeda et al. suggest the claimed plurality of binders. In paragraphs [0064] and [0065] Maeda et al. teach combining a binder with an additive. Maeda et al., however, do not suggest the ratio of core-shell type rubber particles to the total amount of resin binders is 20 to 80 wt. % (characteristic A), as required by claim 1. Further, Maeda et al. disclose, "[t]he amount of the active material in the slurry for electrode according to the present invention is not limited, but . . . most preferably 5 to 200 times as weight of that of the composite

polymer particle.” Thus, Maeda et al. do not suggest the much narrower content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler (characteristic B), as required by claim 1.

In the Response to Arguments, the Examiner opined, “regardless of the application of a binder, a binder necessarily functions to adhere materials together. Maeda teaches that the binder imparts are well-balanced binding power and a binding durability . . . and it would have been obvious . . . to use the Maeda’s binder in various applications that desire binding power and durability.” The characteristics A and B of the present invention, however, greatly affect the viscosity of the slurry and battery performance. By satisfying characteristics A and B, the slurry viscosity suitable for its application, flexibility suitable for winding, and excellent binding ability can be obtained with excellent balance in the present invention. The appropriate amounts and ratio of the plurality of binders cannot be selected based on only the purpose of binding materials together. The porous film is more porous than the electrodes and has weaker mechanical strength. Thus, the criteria for the appropriate amounts and ratio of the plurality of binders will be different for electrodes than for the porous film. Thus, there is no suggestion to modify the binder of Delnick based on the teaching of Maeda et al. to provide the porous film comprising a plurality of resin binders, as required by claim 1.

The claimed lithium ion secondary batteries are further distinguishable over Delnick and Maeda et al. Maeda et al.’s binder (composite polymer particle) is used by dispersing it in a liquid. That is, the binder is dispersed in a liquid that does not dissolve the binder. The binder is introduced into the electrode while maintaining the particulate condition (FIGs. 1 to 9). Maeda notes in paragraph [0053], “[t]he binder composition for battery electrode according to the present invention is obtained by dispersing the binder . . . in a liquid material”. Additionally, in

paragraph [0055], it is noted, “the liquid material is one which ... is capable of preserving the shape of the composite polymer particle when a slurry for battery electrode ... is obtained by mixing the binder composition with an active material and others”.

Delnick, on the other hand, is practiced by dissolving the binder in a liquid. The dissolved binder deposits on the coexisting particles when the solvent is vaporized to form the structure as shown in FIG. 2 of Delnick.

In column 4, lines 30 to 40, Delnick teaches, “[s]pecifically, a separator precursor solution is formulated as an ink comprised of a solid particulate material dispersed in a solution of a polymer binder which is dissolved in a suitable solvent. ... The polymer binder of the ink solution may preferably comprise Polyvinylidene Fluoride-Hexafluoropropylene copolymer which is dissolved in BEEA [2(2Butoxy Ethoxy)Ethyl Acetate] solvent”. There is a clear distinction in Delnick between “a solid particulate material” which is “dispersed” and “a polymer binder” which is “dissolved”. Additionally, “Polyvinylidene Fluoride-Hexafluoropropylene copolymer” mentioned as a preferable binder is a common dissolving-type binder. It is further noted in column 7, lines 42-44 of Delnick, “[t]he solvent to be utilized in the present invention can be any agent or mixture of agents which will dissolve the polymer binder”.

When the Maeda et al. binder is dissolved in a liquid, its particle structure is destroyed. Once the structure is destroyed, it is not reconstructed even though the binder is deposited. Maeda et al. notes in paragraph [0028], “[o]f these heterogeneous phase structures, a core-shell type heterogeneous structure (FIG.1) is preferable”. The core-shell structure, however, cannot be reconstructed once it is destroyed. Therefore, the binder of Maeda et al. cannot be used according to the teaching of Delnick.

Obviousness can be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). There is no suggestion in Delnick and Maeda et al. to modify the battery of Delnick to provide a lithium ion secondary battery comprising a porous film interposed between the positive electrode and the negative electrode, wherein the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler, the resin binder comprises a plurality of resin binders including core-shell type rubber particles and other resin binder, the rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit, the other resin binder comprises at least one selected from the group consisting of fluorocarbon resins, cellulose resins, and polyvinyl pyrrolidone, and the ratio of the core-shell type rubber particles to the total amount of resin binders is 20 to 80 wt. %, as required by claim 1, nor does common sense dictate the Examiner-asserted modification. The Examiner has not provided any evidence that there would be any obvious benefit in making the asserted modification of Delnick and Maeda et al. *See KSR Int'l Co. v. Teleflex, Inc.*, 500 U.S. ____ (No. 04-1350, April 30, 2007) at 20. .

The mere fact that references can be combined or modified does not render the resulting combination obvious unless the prior art also suggests the desirability of the modification. *In re Mills*, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990). Applicants submit that Maeda et al. does not suggest the arrangement of the porous film as alleged by the Examiner.

As, explained above, the binder of Maeda et al. cannot be used according to the teaching of Delnick. Substituting the dispersion of Maeda et al. into the Delnick porous film formation process would render the Delnick's method of forming the porous film unsuitable for its intended purpose. If a proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984); MPEP § 2143.01.

The only teaching of the claimed lithium ion secondary batteries wherein the porous film comprises a porous film interposed between the positive electrode and the negative electrode, wherein the porous film comprises a filler and a resin binder and a content of the resin binder in the porous film is 1.5 to 8 parts by weight per 100 parts by weight of the filler, the resin binder comprises a plurality of resin binders including core-shell type rubber particles and other resin binder, the rubber particles have an adhesive surface portion including at least an acrylonitrile unit, an acrylate unit, or a methacrylate unit, the other resin binder comprises at least one selected from the group consisting of fluorocarbon resins, cellulose resins, and polyvinyl pyrrolidone, and the ratio of the core-shell type rubber particles to the total amount of resin binders is 20 to 80 wt. % is found in Applicants' disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must not be based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Claims 14 and 36 were rejected as being unpatentable over Delnick in view of Maeda et al. and further in view of Murai et al. (U.S. Patent Publication No. 2002/0048704). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action asserted that Delnick modified by Maeda et al. teach a porous film but do not teach a porous film and a separator. The Office Action relied on Murai et al. to cure the deficiencies of Delnick and Maeda et al. The Office Action concluded that Murai et al. teach a separator made of an electrically insulating material that has sufficient strength, such as porous film.

The combination of Delnick, Maeda et al., and Murai et al. does not suggest the claimed lithium ion secondary batteries because Murai et al. do not cure the deficiencies of Delnick and Maeda et al. Murai et al. do not suggest the resin binder comprising a plurality of resin binders including core-shell type rubber particles and other resin binder, as required by claim 1.

Claims 5 and 21-24 were rejected as being unpatentable over Delnick in view of Maeda et al. and further in view of Sheibley (U.S. Patent No. 4,371,596)¹. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action acknowledged that Delnick does not disclose the filler comprising a mixture of a large particle group and a smaller particle group. The Office Action relied on Sheibley to cure the deficiencies of Delnick and Maeda. The Office Action averred that Sheibley teaches a separator comprising a filler material with two distinct particle sizes.

The combination of Delnick, Maeda et al., and Sheibley does not suggest the claimed lithium ion batteries. Claim 5 is allowable for at least the same reasons as independent claim 1, as Sheibley does not suggest a resin binder including core-shell type rubber particles. Additionally, Sheibley is directed to an aqueous electrolyte zinc anode based batteries, not non-aqueous electrolyte lithium ion batteries of the present application. As is noted in column 1, lines 16 to 22 in Sheibley, Sheibley relates to Ag-Zn and Ni-Zn alkaline batteries. These alkaline batteries have totally different characteristics from those of lithium ion secondary batteries, and

¹ The Office rejected claim 5 and claims 21-25 in two separate rejections.

the structure, charge and discharge voltage range, electrolyte composition, and electrode composition are totally different as well. Therefore, one of skill in this art would not combine Sheibley and Delnick. One of skill in the art of non-aqueous lithium ion secondary batteries would not look towards aqueous alkaline batteries to solve a problem with a non-aqueous lithium ion secondary battery.

With respect to independent claim 21, the Office Action concluded that the combination of Delnick modified by Maeda and Sheibley would necessarily have an elongating percentage of the porous film of 15% or more.

The stress tolerance of the porous film of the present application depends on the elongating percentage (*see, e.g.*, Para. [0016] of the present specification). The cited references do not suggest the unexpected improvement of reliability of the battery by controlling the elongating percentage of the porous film (*see, e.g.*, Para. [0016] of the present specification). Table 4 of the present specification, for example, shows that when the amount of resin binder in the porous film is small, the porous film peels, and the porous film with sufficient elongating percentage can not be obtained (*see, e.g.*, Para. [0194] of the present application). Therefore, none of the references, individually or combined, suggest an elongating percentage of the porous film is 15% or more, as required by claim 21.

Furthermore, as explained above, it would not have been obvious to combine Sheibley and Delnick. For example, the required tolerance for the porous film of alkaline batteries (the porous film being in an electrolyte comprising KOH aqueous solution) and the porous film of lithium ion secondary batteries (the porous film being in a non-aqueous electrolyte) is different. It is clear that the elongating percentage of the porous film of lithium ion secondary batteries is not obvious, when the teaching of Sheibley is considered as a whole.

Claim 26 was rejected as being unpatentable over Delnick in view of Maeda et al. and further in view of Sheibley and Murai et al. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action acknowledged Delnick, Maeda et al, and Sheibley do not teach a porous film and a separator. The Office Action relied on Murai et al. to cure the deficiencies of Delnick, Maeda et al., and Sheibley.

Claim 26 is allowable for at least the same reasons as claim 1, as Murai et al. do not cure the deficiencies of Delnick, Maeda et al., and Sheibley.

Claims 16-19 were rejected as being unpatentable over Delnick in view of Maeda et al. and Call (U.S. Patent Publication No. 2002/0136945). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

The Office Action acknowledged that Delnick and Maeda et al. do not teach an average pore size of micropores in the porous film is 0.02 to 0.09 μm . The Office Action relied on Call to cure the deficiencies of Delnick and Maeda et al. Call teaches a microporous separator having a pore size of 0.01 to 5 μm . Call, however, do not cure the deficiencies of Delnick and Maeda et al., as discussed above, thus claims 16 and 18 are allowable for at least the same reasons as independent claim 1.

Further, there is no suggestion of combining the alleged teachings of Call with Delnick and Maeda et al. Call teaches a polymer separator, not a porous film with 1.5 to 8 parts by weight of the resin binder. The separator of Delnick is entirely or substantially entirely a polymer resin, not only 1.5 to 8 parts by weight of resin binder. There is no suggestion that the claimed porosity would result if the separator of Call were substituted for the resin binder of Delnick. On the other hand, if the separator of Call were substituted for the porous film in

Delnick in view of Maeda et al., the porous film would not have the claimed filler content and would not include the specifically claimed binder.

Claim 20 was rejected as being unpatentable over Delnick in view of Maeda et al. and Call, and further in view of Murai et al. The Office Action acknowledged that Delnick, Maeda et al., and Call do not teach a porous film and a separator. The Office Action also acknowledged that Delnick and Maeda et al. do not teach a wound battery. The Office action relied on Murai et al. to cure the deficiencies of Delnick, Maeda et al., and Call.

Claim 20, however, is allowable for at least the same reasons as independent claim 1. Murai et al. do not cure the deficiencies of Delnick, Maeda et al., and Call, as Murai et al. do not suggest selecting the specifically claimed binders for use in the claimed porous film, as required by claim 1.

The dependent claims are allowable for at least the same reasons as the respective independent claims from which they depend and further distinguish the claimed lithium ion secondary batteries. For example, there is no teaching in the cited references of the required concentration gradient of the resin binder, as required by claim 27. The Examiner has **no basis** for asserting that the amount of resin binder is necessarily smaller on one side versus the other side. As disclosed in the present specification (*see, e.g.*, Para. [0096] – [0109]), the amount of binder in any given portion of the porous film can depend on how the porous film is made.

In view of the above amendments and remarks, Applicants submit that this amendment should be entered, the application allowed, and the case passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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